

In the Claims:

1. (Currently amended) An asymmetrical key cryptography method involving a keyholder having a number  $m \geq 1$  of private keys  $Q_1, Q_2, \dots, Q_m$  and respective public keys  $G_1, G_2, \dots, G_m$ , each pair of keys  $(Q_i, G_i)$  (where  $i = 1, \dots, m$ ) satisfying either the relationship  $G_i = Q_i^v \bmod n$  or the relationship  $G_i \times Q_i^v = 1 \bmod n$ , where  $n$  is a public integer equal to the product of  $f$  (where  $f > 1$ ) private prime factors  $p_1, \dots, p_f$ , at least two of which are separate, and the exponent  $v$  is a public integer equal to a power of 2, wherein the method comprises the steps of: which method is characterized in that

arranging exponent  $v$  to have the relationship  $v = 2^{b+k}$ ,

where  $k$  is a strictly positive integer and  $b = \max(b_1, \dots, b_f)$ , where  $b_j$  (where  $j = 1, \dots, f$ ) is the highest integer such that  $(p_j - 1) / 2^{b_j - 1}$  is even; [[,]] and

arranging each public key  $G_i$  (where  $i = 1, \dots, m$ ) is of to have the form  $G_i = g_i^{2^{a_i}} \bmod n$ ,

where the base numbers  $g_i$  are integers strictly greater than 1 and the numbers  $a_i$  are integers such that  $1 \leq a_i \leq b$  and at least one of them is strictly greater than 1.

2. (Currently amended) A method according to claim 1, ~~characterized in that~~ wherein at least one of said prime factors  $p_1, \dots, p_f$  is congruent to 1 modulo 4 and the integers  $a_i$  (where  $i = 1, \dots, m$ ) are all equal to said number  $b$ .

3. (Currently amended) A method according to claim 1 ~~or claim 2, characterized in that~~, wherein said base numbers  $g_1, \dots, g_m$  include at least one number  $g_s$  and said prime factors  $p_1, \dots, p_f$  include at least two numbers  $p_t$  and  $p_u$  other than 2 such that, given said numbers  $b_1, \dots, b_f$ ,

if  $b_t = b_u$ , then  $(g_s | p_t) = - (g_s | p_u)$ , and

if  $b_t < b_u$ , then  $(g_s | p_u) = -1$ ,

where  $(g_s | p_t)$  and  $(g_s | p_u)$  denote the Legendre symbols of  $g_s$  relative to  $p_t$  and  $p_u$ .

4. (Currently amended) A method according to claim 1, wherein ~~any one of the preceding claims, characterized in that~~ the base numbers  $g_1, \dots, g_m$  are prime numbers.

5. (Currently amended) A method according to claim 1 ~~any one of claims 1 to 4,~~ involving a controller and said keyholder, here called the claimant, ~~characterized in that it~~ wherein the method comprises the following steps:

the claimant chooses at random an integer  $r$ , calculates the witness  $R = r^v \bmod n$  and sends the witness to the controller,

the controller chooses at random  $m$  challenges  $d_1, d_2, \dots, d_m$  ~~where  $i = 1, \dots, m$~~  and sends the challenges to the claimant,

the claimant calculates the response

$$D = r \times Q_1^{d_1} \times Q_2^{d_2} \times \dots \times Q_m^{d_m} \bmod n,$$

and sends the response to the controller, and

the controller calculates

$$D^v \times G_1^{\varepsilon_1 d_1} \times G_2^{\varepsilon_2 d_2} \times \dots \times G_m^{\varepsilon_m d_m} \mod n$$

where, for  $i = 1, \dots, m$ ,  $\varepsilon_i = +1$  if  $G_i \times Q_i^v = 1 \mod n$  and  $\varepsilon_i = -1$  if  $G_i = Q_i^v \mod n$ ,

and verifies that the result is equal to the witness  $R$ .

6. (Currently amended) A method according to claim 1 ~~any one of claims 1 to 4~~, enabling a controller to verify that a message  $M$  that it has received was sent to it by said keyholder, here called the claimant, ~~characterized in that it~~ wherein the method comprises the following steps:

the claimant chooses at random an integer  $r$  and first calculates the witness  $R = r^v \mod n$ , then calculates the token  $T = h(M, R)$ , where  $h$  is a hashing function, and finally sends the token  $T$  to the controller,

the controller chooses at random  $m$  challenges  $d_1, d_2, \dots, d_m$  where  $i = 1, \dots, m$ , and sends the challenges to the claimant,

the claimant calculates the response

$$D = r \times Q_1^{d_1} \times Q_2^{d_2} \times \dots \times Q_m^{d_m} \mod n \text{ and sends the response to the controller, and}$$

the controller calculates  $h\left(M, D^v \times G_1^{\varepsilon_1 d_1} \times G_2^{\varepsilon_2 d_2} \times \dots \times G_m^{\varepsilon_m d_m} \mod n\right)$  where, for  $i = 1, \dots, m$ ,  $\varepsilon_i = +1$  if  $G_i \times Q_i^v = 1 \mod n$  and  $\varepsilon_i = -1$  if  $G_i = Q_i^v \mod n$ , and verifies that the result is equal to the token  $T$ .

7. (Currently amended) A method according to claim 5, wherein ~~or claim 6,~~  
~~characterized in that~~ the challenges satisfy the condition  $0 \leq d_i \leq 2^k - 1$  for  $i = 1, \dots, m$ .

8. (Currently amended) A method according to claim 1 ~~any one of claims 1 to 4,~~  
enabling said keyholder, here called the signatory, to sign a message  $M$  that it sends to a  
controller, ~~characterized in that it~~ wherein the method comprises the following steps:

the signatory chooses at random  $m$  integers  $r_i$ , where  $i = 1, \dots, m$ , and first calculates the  
witnesses  $R = r^v \bmod n$ , then calculates the token  $T = h(M, R_1, R_2, \dots, R_m)$ , where  $h$  is a hashing  
function producing a word of  $m$  bits, and finally sends the token  $T$  to the controller,

the signatory identifies the bits  $d_1, d_2, \dots, d_m$  of the token  $T$ ,

the signatory calculates the responses  $D_i = r_i \times Q_i^{d_i} \bmod n$  and sends the responses to the  
controller, and

the controller calculates

$$h\left(M, D_1^v \times G_1^{\varepsilon_1 d_1} \bmod n, D_2^v \times G_2^{\varepsilon_2 d_2} \bmod n, \dots, D_m^v \times G_m^{\varepsilon_m d_m} \bmod n\right)$$

where, for  $i = 1, \dots, m$ ,  $\varepsilon_i = +1$  if  $G_i \times Q_i^v = 1 \bmod n$  and  $\varepsilon_i = -1$  if  $G_i = Q_i^v \bmod n$ , and verifies  
that the result is equal to the token  $T$ .

9. (Currently amended) An electronic circuit including a processor and memories,  
~~characterized in that it~~ wherein the electronic circuit can be programmed to act as said keyholder  
in executing a method according to claim 1 ~~any one of claims 1 to 8.~~

10. (Currently amended) A dedicated electronic circuit, ~~characterized in that it includes~~ including microcomponents enabling it the electronic circuit to process data in such manner as to act as said keyholder in executing a method according to claim 1 ~~any one of claims 1 to 8.~~

11. (Currently amended) A portable object adapted to be connected to a terminal to exchange data with that terminal, ~~characterized in that it~~ wherein the portable object includes an electronic circuit according to claim 9 ~~or claim 10~~ and is adapted to store identification data and private keys specific to said key holder.

12. (Currently amended) A terminal adapted to be connected to a portable object to exchange data with that portable object, ~~characterized in that it~~ wherein the terminal includes a data processing device programmed to act as said controller in executing a method according to claim 1 ~~any one of claims 1 to 8.~~

13. (Currently amended) A cryptography system comprising:  
a portable object ~~according to claim 11~~ adapted to be connected to a terminal to exchange data with that terminal, wherein the portable object includes an electronic circuit having a processor and memories, wherein the electronic circuit can be programmed to act as said keyholder in executing a method according to claim 1, and wherein the portable object is adapted to store identification data and private keys specific to said key holder; and

a terminal ~~according to claim 12~~ adapted to be connected to the portable object to exchange data with that portable object, wherein the terminal includes a data processing device programmed to act as said controller in executing a method according to claim 1.

14. (Currently amended) Non-removable data storage means containing electronic data processing program code instructions for, as said keyholder, executing the steps of any of the methods of a method according to claim 1 ~~any one of claims 1 to 8.~~

15. (Currently amended) Partially or totally removable storage means containing electronic data processing program code instructions for, as said keyholder, executing the steps of a method according to claim 1 ~~any one of claims 1 to 8.~~

16. (Currently amended) A data processing device comprising storage means according to claim 14 ~~or claim 15.~~

17. (Currently amended) Non-removable data storage means containing electronic data processing program code instructions for, as said controller, executing the steps of any of the methods of a method according to claim 1 ~~any one of claims 1 to 8.~~

18. (Currently amended) Partially or totally removable data storage means containing electronic data processing program code instructions for, as said controller, executing the steps of a method according to claim 1 ~~any one of claims 1 to 8.~~

19. (Currently amended) A data processing device, ~~characterized in that~~ wherein it comprises storage means according to claim 17 ~~or claim 18~~.

20. (Currently amended) A cryptography system comprising:  
a data processing device ~~according to claim 16~~ including non-removable storage means containing electronic data processing program code instructions for, as said keyholder, executing the steps of any of the methods of a method according to claim 1; and

a data processing device ~~according to claim 19~~ including non-removable data storage means containing electronic data processing program code instructions for, as said controller, executing the steps of any of the methods of a method according to claim 1.

21. (Currently amended) A computer program containing instructions such that, when said program controls a programmable data processing device, said instructions cause said data processing device to execute a method according to claim 1 ~~any one of claims 1 to 8~~.

22. (New) A method according to claim 4, wherein the base numbers  $g_1, \dots, g_m$  are chosen from the first 54 prime numbers.